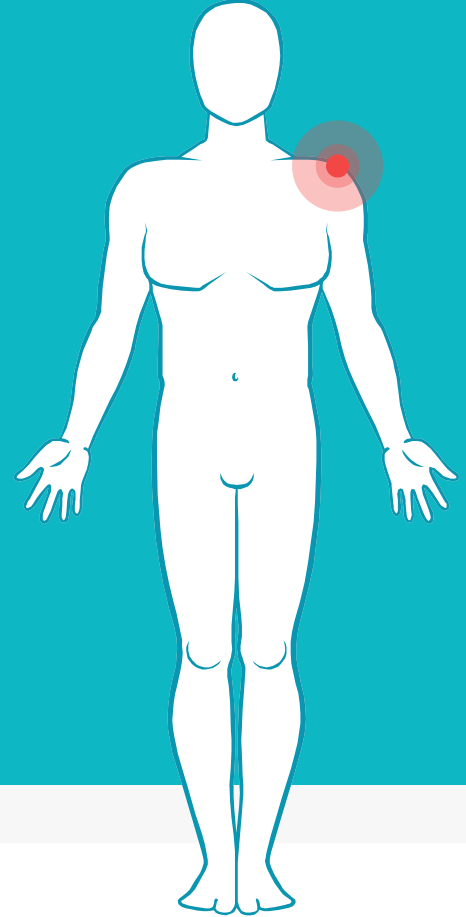
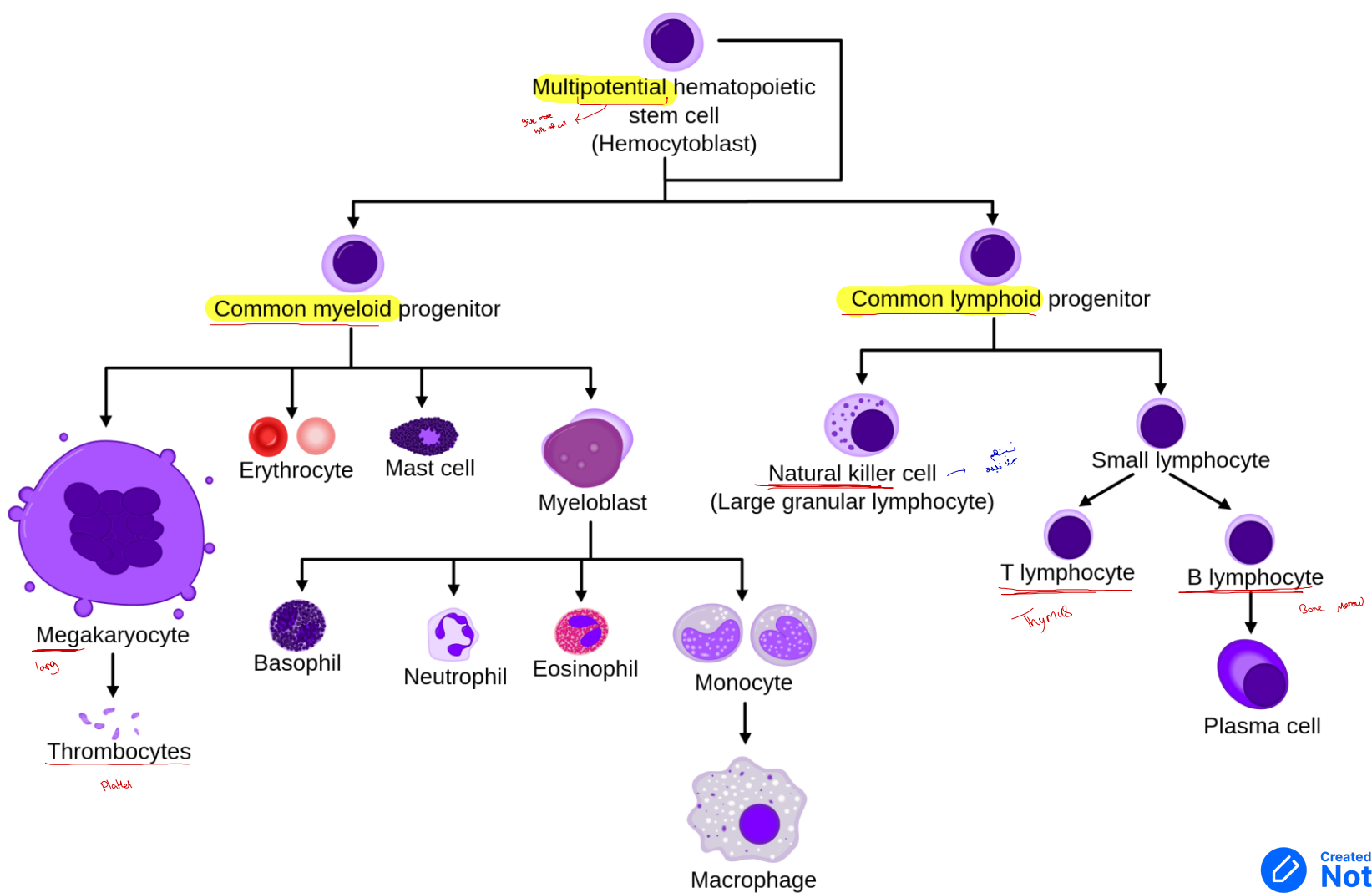


Hematopoietic & Lymphoid System

White Cell disorders

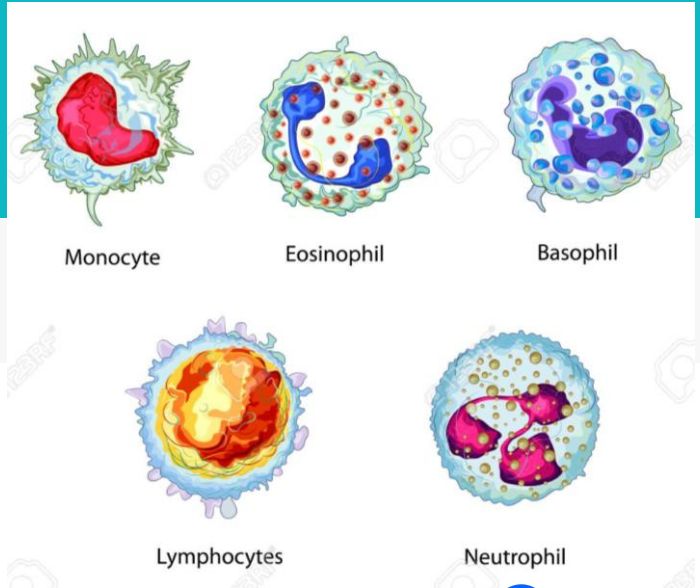


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3/31/2025



1. Nonneoplastic disorders of white cells

Not a cancer



- ▶ Disorders include **deficiencies** (abnormally **low count** → **leukopenias**) and **proliferations** (leukocytosis), which may be **reactive** or **neoplastic**.
- high count
- من مطالبه حفظ

Cell Type	
White cells ($\times 10^3/\mu\text{L}$)	4.8-10.8
Granulocytes (%)	40-70
Neutrophils ($\times 10^3/\mu\text{L}$)	1.4-6.5
Lymphocytes ($\times 10^3/\mu\text{L}$)	1.2-3.4
Monocytes ($\times 10^3/\mu\text{L}$)	0.1-0.6
Eosinophils ($\times 10^3/\mu\text{L}$)	0-0.5
Basophils ($\times 10^3/\mu\text{L}$)	0-0.2
Red cells ($\times 10^3/\mu\text{L}$)	4.3-5, men; 3.5-5, women
Platelets ($\times 10^3/\mu\text{L}$)	150-450

5 major types of WBCs

- ▶ **Neutrophils**
- ▶ Lymphocytes
- ▶ Monocytes
- ▶ **Eosinophils**
- ▶ **Basophils**

Neutropenia/Agranulocytosis

- ▶ Neutropenia: a **reduction** in the number of **granulocytes** in blood, when **severe**, agranulocytosis. (<500)
- ▶ **Most common** Leukopenia. Major cell → neutrophils
تکثیر البانی ناکافی
- ▶ Neutropenic persons are **susceptible to severe**, potentially fatal bacterial and fungal infections. → first line of defense
- ▶ Two major mechanisms:
 - ❖ Decrease production
 - ❖ Increase peripheral destruction of neutrophils → bone marrow

→ spleen x

Neutropenia/Agranulocytosis

Decrease production

- ▶ Marrow **hypoplasia** in **patients** who receive chemotherapy or radiation therapy
- ▶ Leukemia or other tumors **replacing the marrow** (leukemias)
- ▶ Medications
 - Cancer therapy
anti-cancer drug
immunomodulation drug: methotrexate
drug of " " = biologics therapy
 - or benign disease like anemia, TB
- ▶ Certain types of **neoplastic lymphocytic proliferations** involving marrow. Splenic leukemia

Neutropenia/Agranulocytosis

Increased peripheral destruction/consumption:

- ▶ Autoimmune destruction (ANCA)
- ▶ Overwhelming bacterial, fungal or rickettsial infection (peripheral use)
- ▶ Splenomegaly (sequestration & accelerated removal of neutrophils.)

Some normal use of neutrophils
they die → depend on how long

or 10 days

prolonged

Neutropenia/Agranulocytosis

Clinical features:

- ▶ **Infections**
- ▶ Fever, chills, malaise.
- ▶ Mucocutaneous necrotizing ulcers
- ▶ High risk of sepsis → bacteraemia in the blood

Tx: broadspectrum antibiotics (bacterial and fungal), granulocyte colony-stimulating factor (G-CSF).

analoge → صانعة الحبيبات
المبيدة

Lymphopenia

- ▶ Much **less common**.
- ▶ Associated with **rare congenital immunodeficiency diseases**, **advanced human immunodeficiency virus (HIV) infection**, & **high doses of corticosteroids Tx**.
- ▶ Certain **acute viral infections** → stems from lymphocyte **redistribution** (to **lymph nodes** & **increased adherence to endothelial cells**) rather than a **decrease in the number**.

↓ Lymphopenia
 ↑ Leukocytosis
 (due to increased release of neutrophils & monocytes)

سبب ابو العدوى
 هبات تزوج لكان
 infection

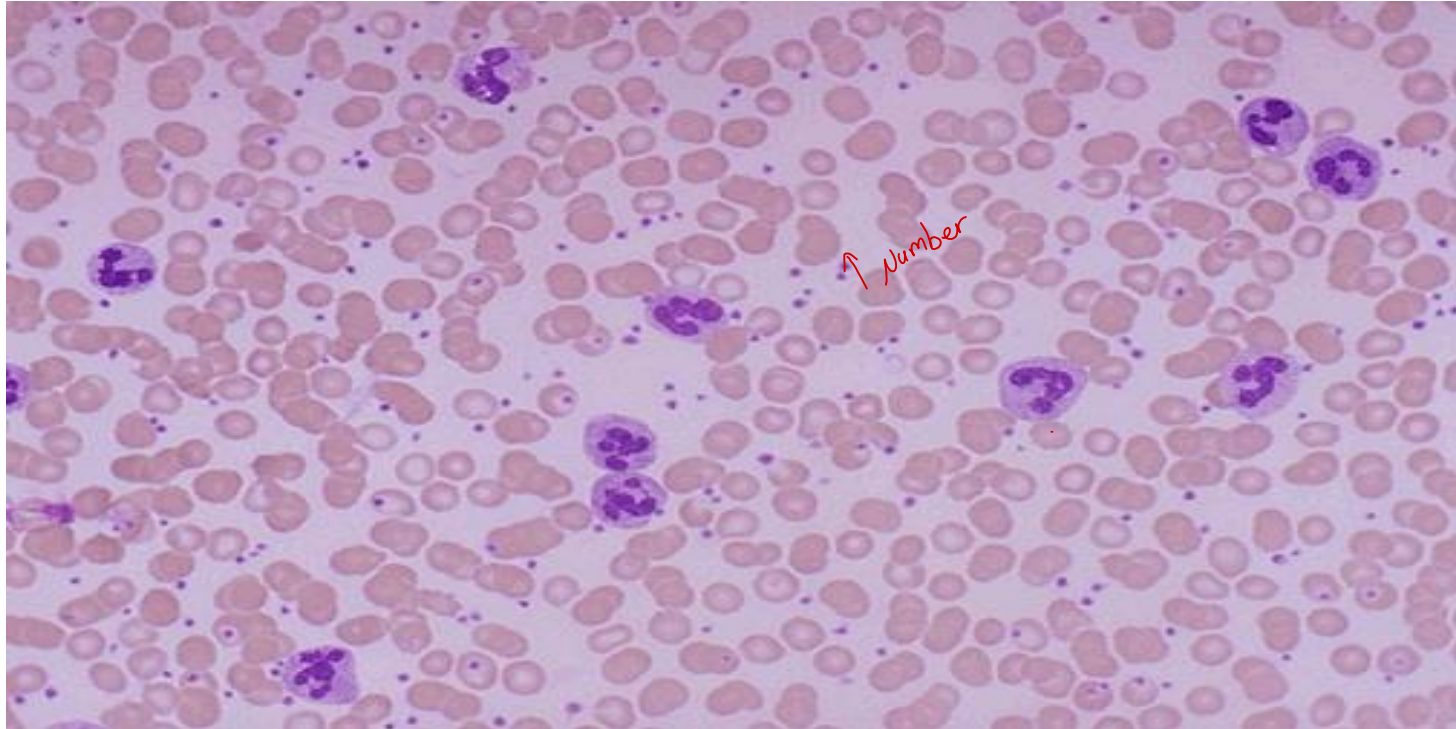
Leukocytosis

- ▶ **Increase** in the number of **white cells** in the blood.
- ▶ A common reaction to a **variety of inflammatory** states.
- ▶ Leukocytoses are relatively **nonspecific** and are classified according to the **particular white cell series** that is affected:

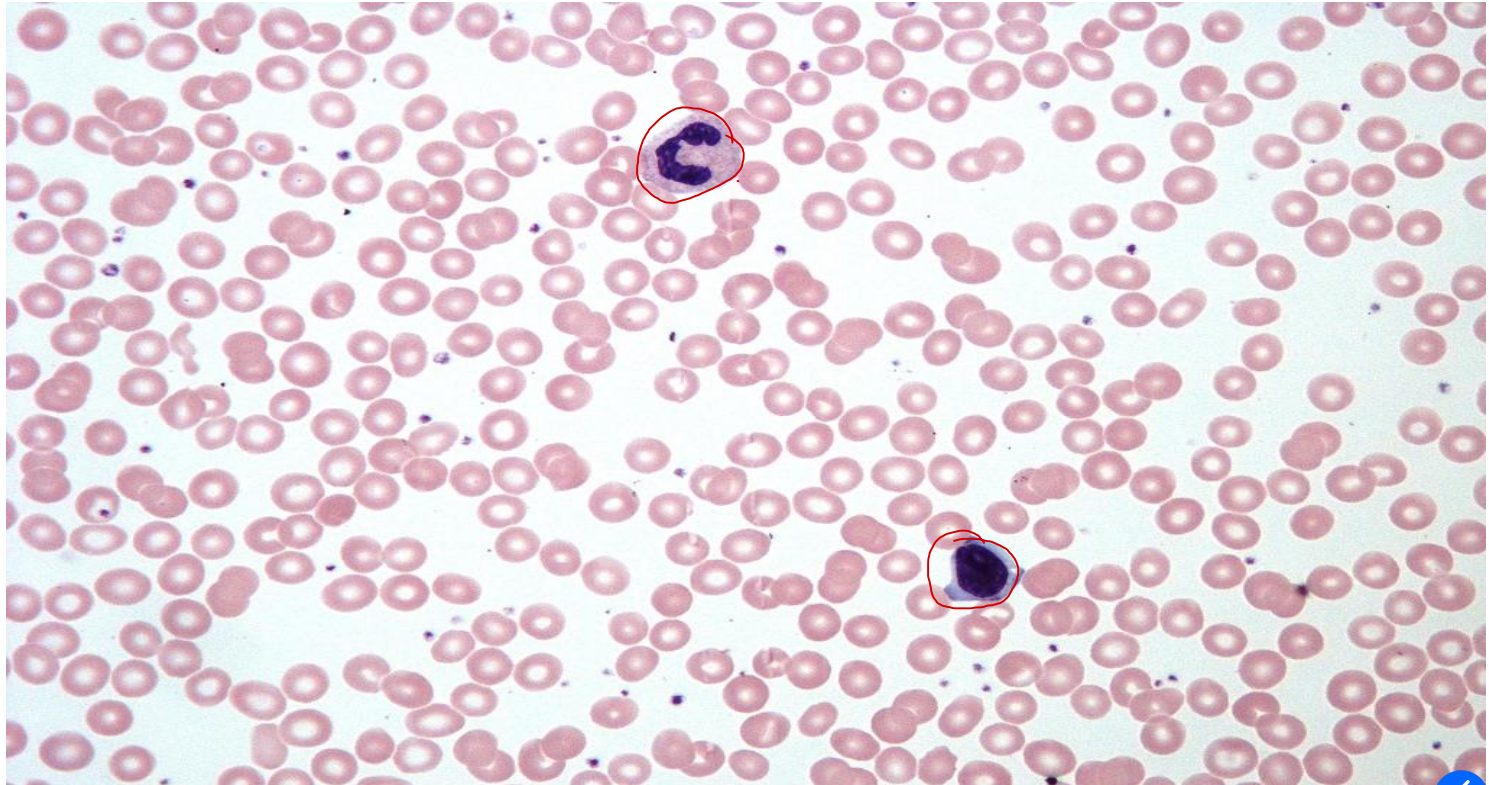
1) **Neutrophilic**: **Acute bacterial infections**, sterile inflammation caused by tissue necrosis or burn.

MC
No infection
sterile

Leukocytosis - neutrophilia

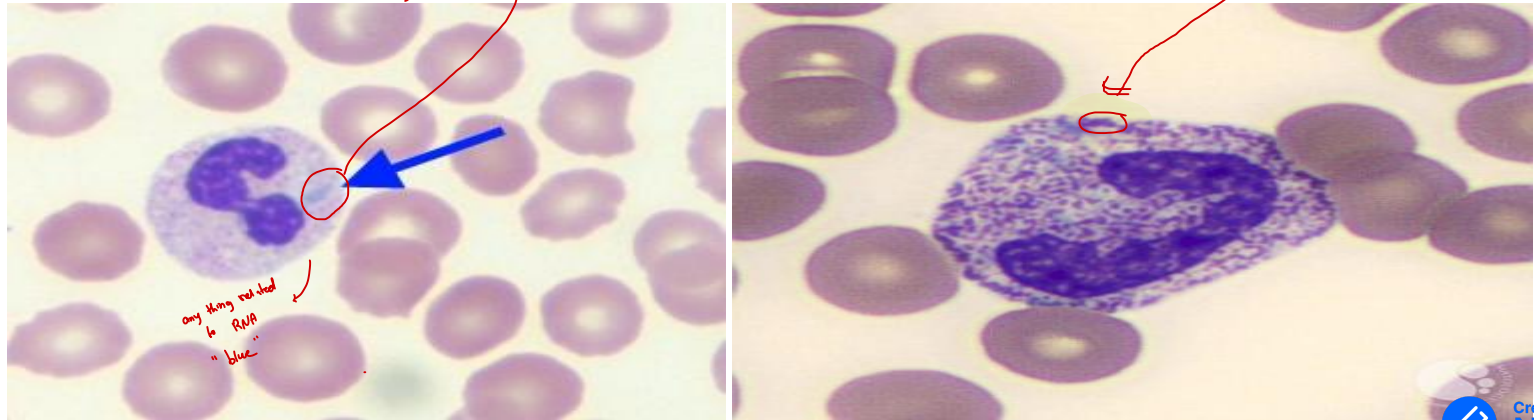


Normal Blood film



Leukocytosis - neutrophilia

In **sepsis** or **severe inflammation** neutrophilia is accompanied by morphologic changes: + **cytoplasmic vacuoles** → *تخلخل*
 + **Toxic granules**, *اختتام* coarser & darker than normal granules
 + **Döhle bodies**: patches of dilated ER (appear → sky-blue cytoplasmic "puddles." → *طيرة*)



Leukocytosis

زيادة نسبة الدم الأبيض
عندما يكون في الارتفاع

- ▶ **Eosinophilic:** (eosinophilia) Allergic disorders (e.g., asthma), parasitic infestations or drugs. ① IL5 IL4 . IgM
- ▶ **Basophilic:** (basophilia) Rare, often indicative of a myeloproliferative disease. ← abnormality of bone marrow + Normally in very young infant
- ▶ **Monocytosis** Chronic infections (e.g., tuberculosis), autoimmune disorders; inflammatory bowel diseases.
- ▶ **Lymphocytosis;** chronic immunologic stimulation (e.g., tuberculosis, brucellosis); viral infections (e.g., HAV, CMV, EBV).

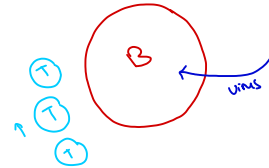
Leukemoid reaction

- ▶ Happens in severe infections, many immature granulocytes appear in the blood, mimicking a myeloid leukemia
- ▶ must be differentiated from true white cell malignancies. (e.g., CML);
 - + Younger age,
 - + No BCR/ABL fusion gene
 - + Subsides with treatment of underlying infection

تفريقا
در
اميز

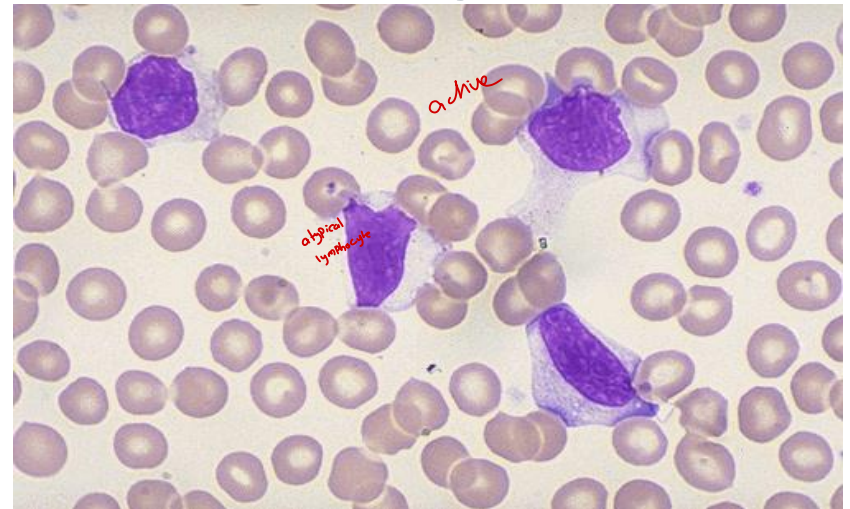
Infectious mononucleosis

- ▶ Acute, self-limited disease of adolescents & young adults.
- ▶ Caused by Epstein-Barr virus (EBV), herpesvirus family.
- ▶ EBV invades B-cells & cause them to proliferate, cytotoxic (CD8+ T-cells) respond against B-cells.
- ▶ Usually present with:
 1. Fever, sore throat, generalized lymphadenitis
 2. Lymphocytosis of activated CD8+ T cells. (up to 18,000)

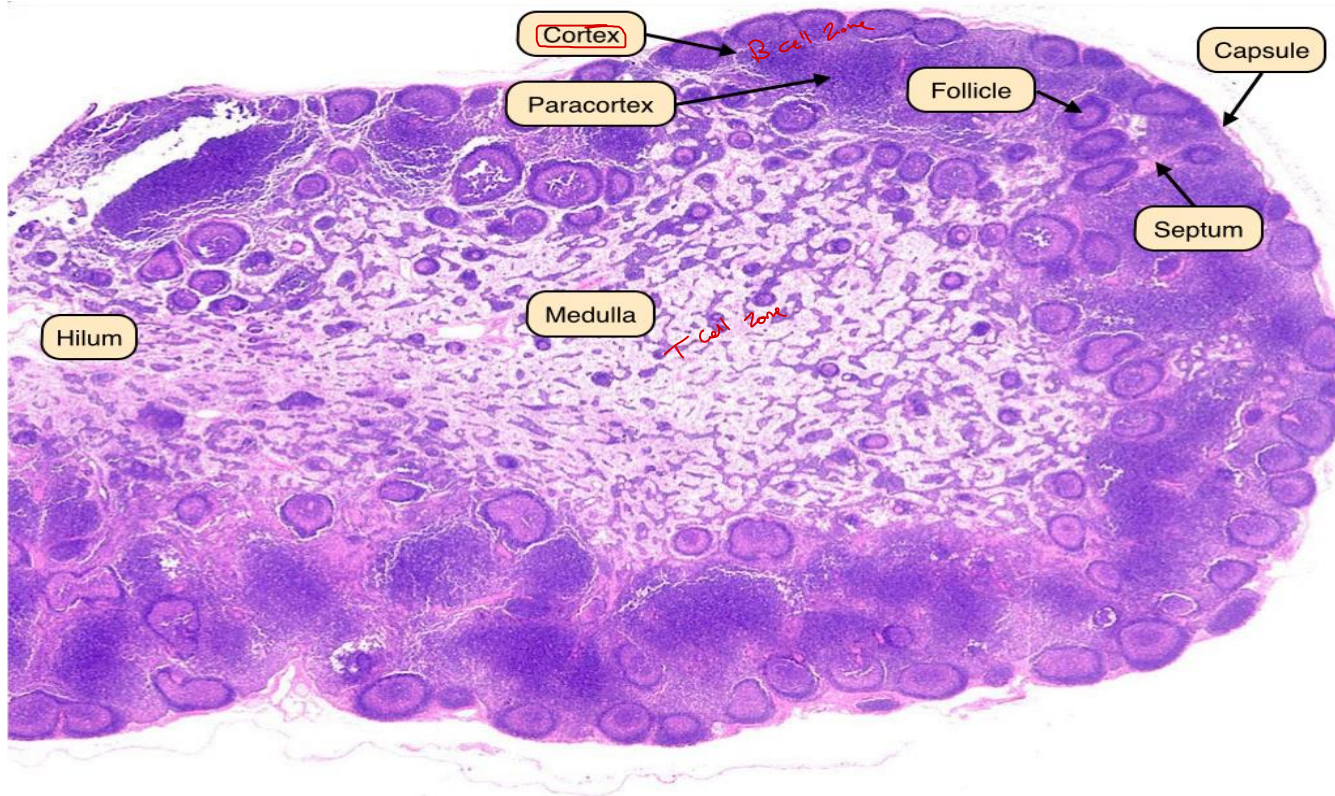


Infectious mononucleosis

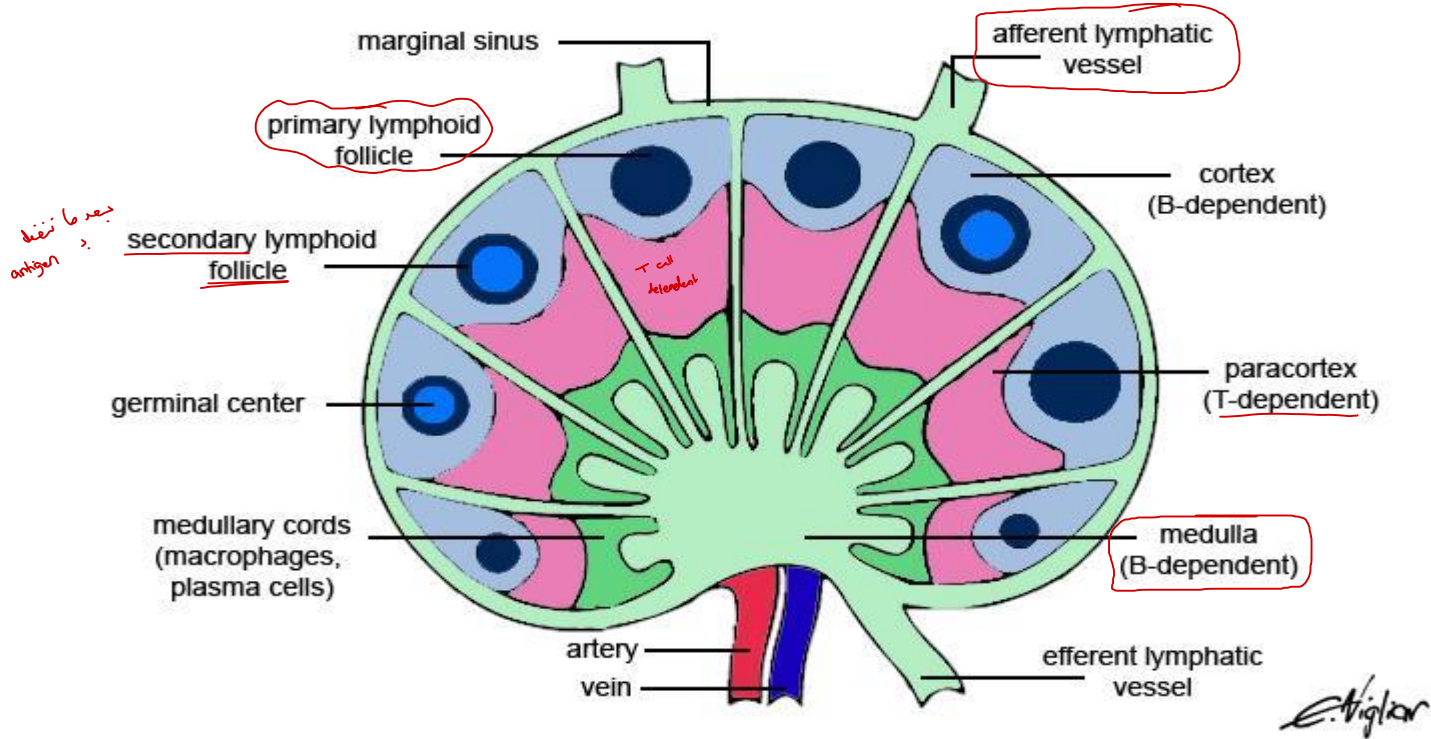
- ▶ More than half of these cells are **large atypical lymphocytes**; with an **oval, indented, or folded nucleus** & **abundant cytoplasm** with a **few azurophilic granules**



Reactive Lymphadenitis




Reactive Lymphadenitis



Reactive Lymphadenitis

Acute Nonspecific Lymphadenitis

- Can be:
 - Localized → draining a local infection. 
 - Generalized → systemic infectious & inflammatory conditions ^{TB}
- Inflamed nodes are swollen & tender.
- With infection control lymph nodes may revert to a normal appearance or, if damaged, undergo scarring.

Reactive Lymphadenitis

Histologic morphology:

- ▶ Large follicles with germinal center formation → *يعني بيروا Secondary*
- ▶ Frequent GC mitoses & macrophages
- ▶ Sinus enlargement with histiocytes
- ▶ Parafollicular neutrophils, necrosis and possible pus formation (If pyogenic microbes)

Reactive Lymphadenitis

Chronic Nonspecific Lymphadenitis

- ▶ Depending on the **causative agent**, chronic nonspecific lymphadenitis can assume one of three patterns:
 - 1) Follicular hyperplasia. **B-cells**
 - 2) Paracortical hyperplasia. **T-cells**
 - 3) Sinus histiocytosis. **Macrophages**

Reactive Lymphadenitis

Chronic Nonspecific Lymphadenitis - **Follicular hyperplasia**.

B-cells
جذبات الليمفاوية
antibody

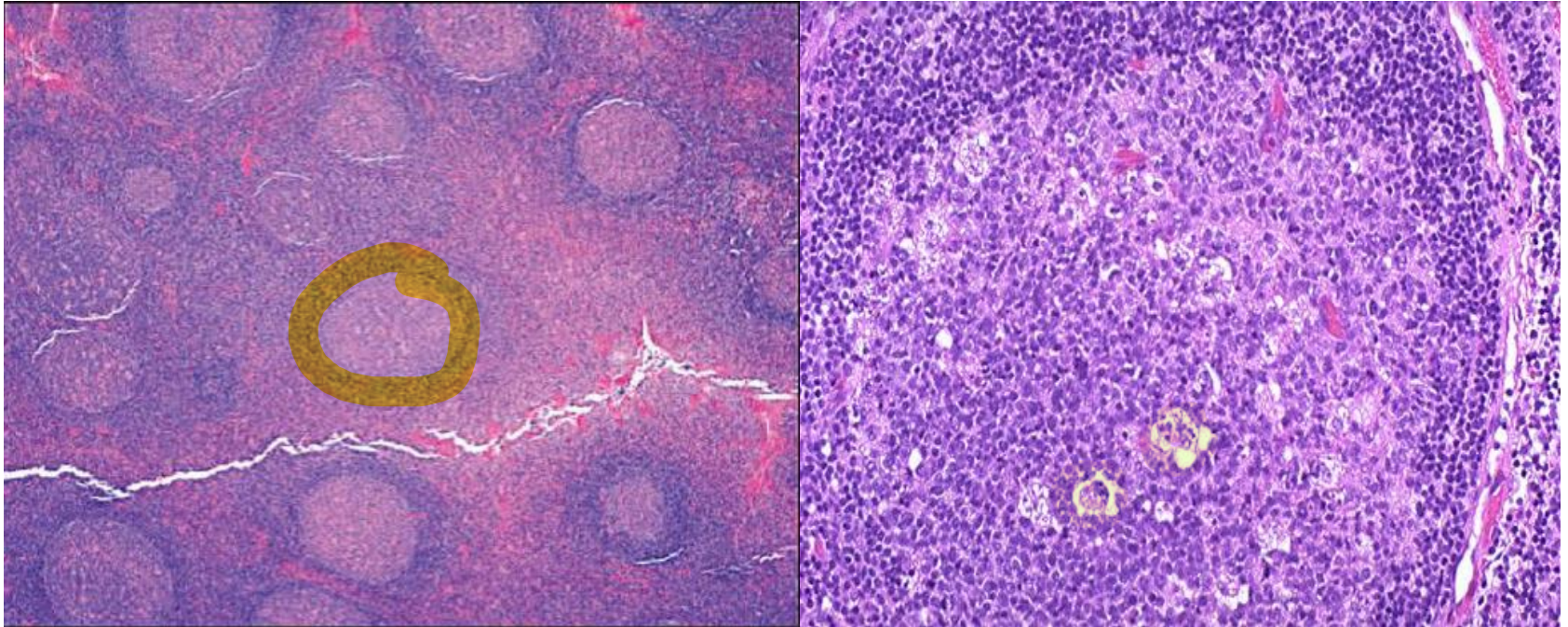
- ▶ Stimuli that activate humoral immune responses.
- ▶ defined by the presence of large germinal centers (secondary follicles), With tingible-body macrophages
- ▶ Causes include rheumatoid arthritis, toxoplasmosis, & early stages of infection with HIV

↳ any thing related for immunoglobulin

AB ← الأجسام المضادة

Reactive Lymphadenitis

Chronic Nonspecific Lymphadenitis - Follicular hyperplasia.



Reactive Lymphadenitis

الحالة الالتهابية

Chronic Nonspecific Lymphadenitis - Follicular hyperplasia.

This form of hyperplasia is morphologically similar to follicular lymphoma, Features **favoring** a reactive (nonneoplastic) hyperplasia include:

- (1) preservation of the lymph node architecture.
- (2) Variation in the shape and size of the follicles.
- (3) Frequent GC mitotic figures & phagocytic macrophages, & recognizable light and dark zones. (absent in neoplastic follicles)

Reactive Lymphadenitis

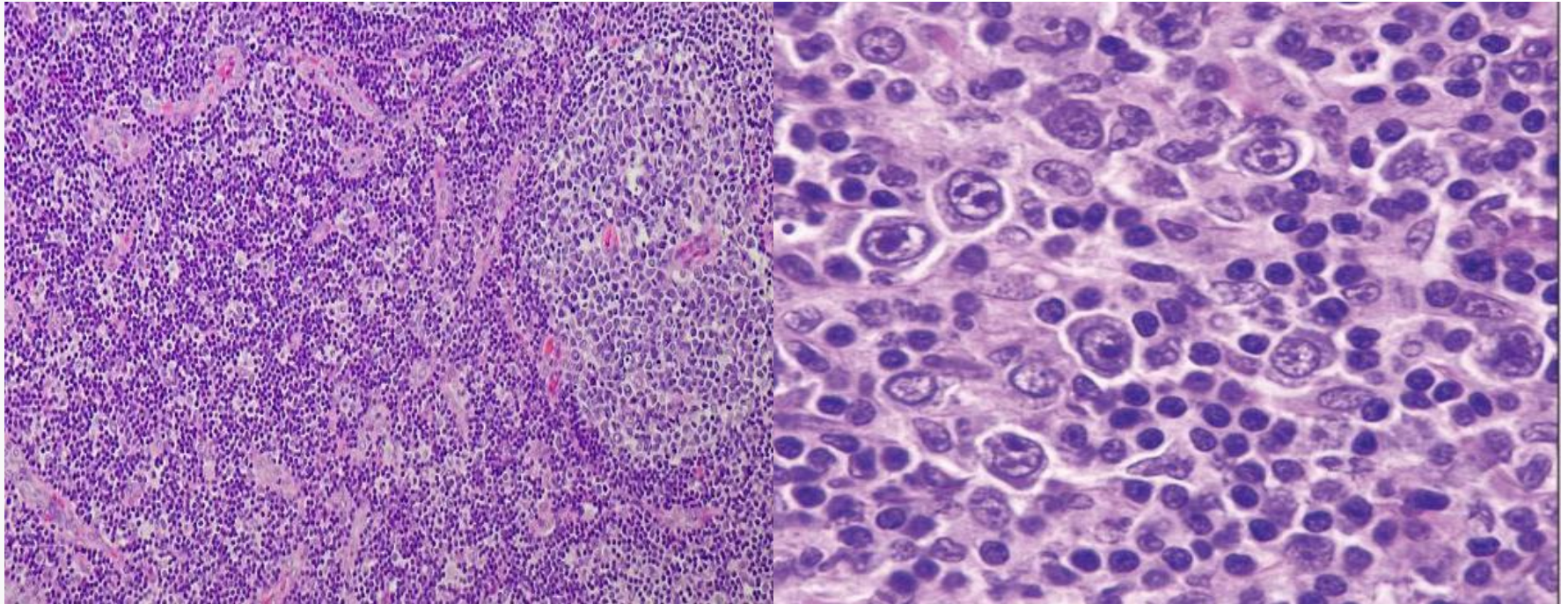
Chronic Nonspecific Lymphadenitis - Paracortical hyperplasia

- ▶ Caused by immune reactions involving the T cell regions.
- ▶ Activated parafollicular T cells transform into large proliferating immunoblasts → that efface B cell follicles.
- ▶ Encountered in:
 - 1) viral infections
 - 2) vaccinations (e.g., smallpox).
 - 3) Drugs induced immune reactions (phenytoin)

بیانہ مکلف

Reactive Lymphadenitis

Chronic Nonspecific Lymphadenitis - Paracortical hyperplasia



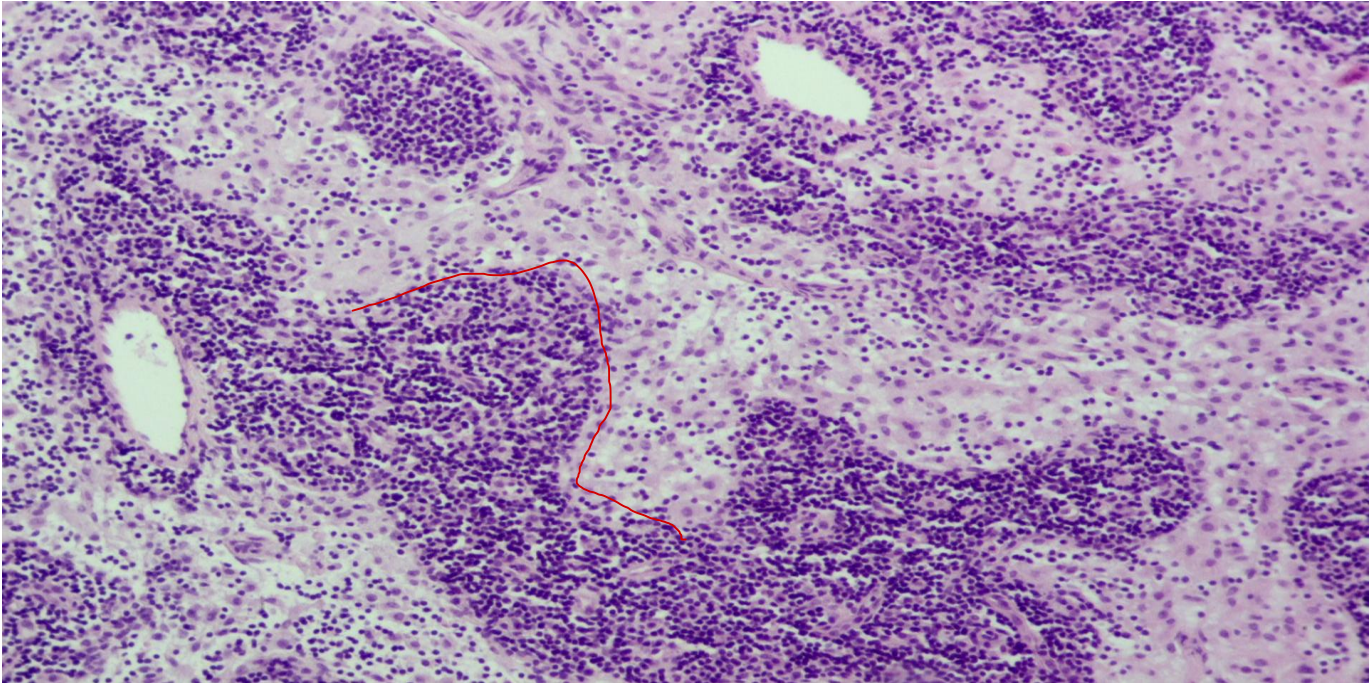
Reactive Lymphadenitis

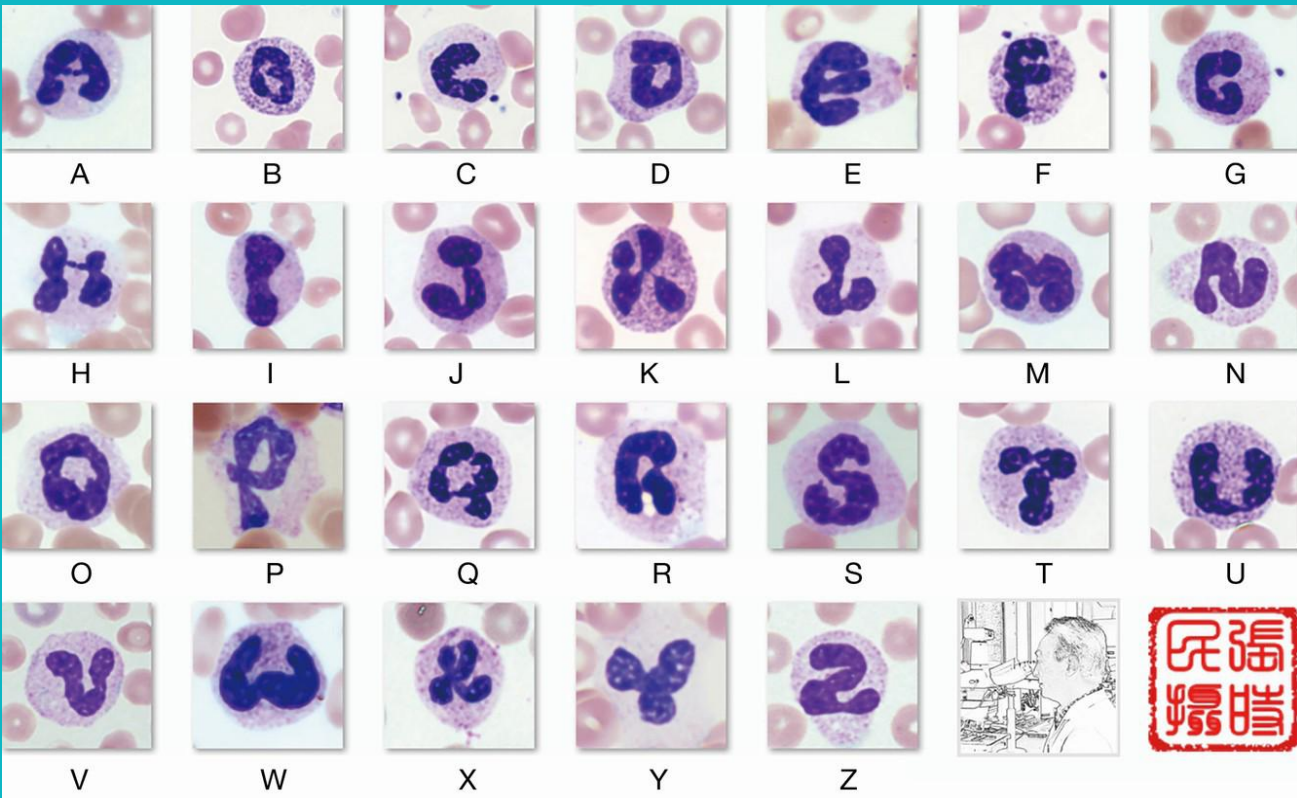
Chronic Nonspecific Lymphadenitis - Sinus Histiocytosis

- ▶ Distention and prominence of the lymphatic sinusoids, due to:
 - 1) Marked hypertrophy of lining endothelial cells.
 - 2) An infiltrate of macrophages (histiocytes).
 - ▶ In lymph nodes draining cancers.
 - ▶ Represent an immune response to the tumor or its products. *• Skin infection • Melanin Production*

Reactive Lymphadenitis

Chronic Nonspecific Lymphadenitis - Sinus Histiocytosis





THANK YOU!